Application of Cloud Computing in Teaching and Learning in a Post Graduate program at Open University Malaysia

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Abstract

Technology evolvement has a high impact to teaching and learning strategies. Virtualization in computing technology has widened user's perspective on communication. Communication seems to be one of the important factors that contribute to the effectiveness of content delivery in terms of production of quality learning outcomes. Users who actively involve in communication either asynchronously or synchronously become constructive and critical by arousing curiosity which in turn will lead to students becoming more innovative and independent. The use of cloud computing in teaching and learning have given advantage to learners in constructing their own content. The aim of this study is to observe and examine the pattern of communication between eight postgraduate students in Master of Instructional Design and Technology (MIDT) program. This study also aims to clarify the status of teaching and learning activities in cloud computing in terms of the models and approach. The simulated learning environment embedded into cloud computing strategies is design according to the working definition. The student undergoes the simulated learning environment. The pattern of communication between students is studied and analyzed to gain insight on the number of communication between student and student, and between student and lecturer. The pattern will also reveal the number of interaction between nodes through MyVLE, Edmodo, Skype and email. This study will report the quality of communication as part of the learning outcome derived from the learning approach. It will also report the seriousness of the students and lecturer in participating in online discussion. The communication outcomes will lead to the synthesis of all information provided in simulated learning environment (SLE) embedded in cloud learning environment (CLE). The result of this study will assist the instructor in improving the delivery platform, specifically on selecting the appropriate application and strategizing the teaching method through modeling through technology.

Keywords: Cloud computing in teaching and learning, communication pattern, interface design, simulated learning environment, cloud learning environment.

Introduction

Cloud computing according to its terms is the most appropriate means to improve teaching and learning in distant. The method applied by Open University Malaysia (OUM) through Open Distance Learning (ODL) since its establishment in 2001. OUM has an opportunity to reach as many students, locally and internationally. Regardless of technological constraint, ODL have enabled OUM to automated most of its learning management, from production of its learning modules to the content delivery. The development process of its learning resources is flexible and cost effective. Two notable approaches used in delivering the courses in OUM were blended learning and fully online learning.

OUM OER (Open Educational Resources) reported since its establishment in 2001, *more than 70 programmes comprising over 900 courses with a cumulative enrolment of over 90,000* (OUM OER, 2010). The flexibility of the teaching and learning strategy and flexible entry have given choices to the working adult with different background and profession to pursue their study at OUM. Instructors in OUM have opportunity to explore and deliver their content in a flexible way too.

ODL is well accepted by Malaysian Qualification Agency (MQA). MQA defined ODL *as the provision of flexible educational opportunities in terms of access and multiple modes of knowledge acquisition* (Malaysian Qualification Agency (MQA), 2011:2).

Background of the Study

Cloud Computing Defined

Virtual, virtualization and cloud are the main keywords closely related to cloud computing. The Free Dictionary defined virtual as having the essence or effect but not the appearance or form. Virtualization is defined as *the act of creating a virtual version of something, including but not limited to virtual hardware platform, operating system, storage device, or network resources* (Wikipedia, 2014).

The advancement of internet technology have created more opportunity for instructor and learners to interact efficiently. Virtualization makes this more efficient. Cloud computing, which wholly rely on virtualization have taken this advantage to play its role in providing more space for online communication. Wikipedia (2014) stated "*the main enabling technology for cloud computing is virtualization. Virtualization generalizes the physical infrastructure, which is the most rigid component, and makes it available as a soft component that is easy to use and manage*" (Wikipedia, 2014).

National Institute of Standards and Technology (NIST), US Department of Commerce (2011) defined cloud computing as*a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction* (Mell&Grance, 2011). Application of cloud computing in teaching and learning seems to work well with the support of collection of a large system provided in the cloud. Its flexibility in terms of accessibility, information retrieval and documentation, is undeniable due to the distributed processing power. It is in line with the definition by NMC Horizon Reports (2008) *stated the cloud is the term for networked computers that distribute processing power, applications, and large systems among many machines. Cloud-based applications do not run on a single computer; instead they are spread over a distributed cluster, using storage space and computing resources from many available machines as needed.*

Working Definitions

Cloud computing in the case of this study focuses on the usage of the facilities provided in cloud computing itself. Cloud computing in relation to teaching and learning activities can be defined as a virtualization of learning modes through various applications provided in the "cloud" to support a dynamic interaction and sharing of knowledge among users in Cloud Learning Environment (CLE).

In order to operationalize the learning mode in CLE, teachers and students should adjust and align themselves to be a well equipped person accepting the challenges and constraint in online learning activities. Due to the openness of large resources sometimes integrated, learners might have constraint in finding detailed information about the resources. *A cloud represents one or more unified resource entities, and renders users/applications with services to access those resources without knowing the detailed information*. (Bo Dong, QinghuaZheng, Jie Yang, Haifei Li &MuQiao, 2009)

Cloud Learning Environment

In online learning, most of the lecturers and students spend their time on the internet through virtual communication. Content delivered through the Internet emerged through dynamic communication by sharing them in the 'cloud.' It is important to have a place to store all information stated through their sharing session. *Cloud computing seems can play its roles. Cloud Computing offers an interoperable way of providing and sharing services such as computing and data storage over the Internet* (Cao Kang, 2011)

Learning in the cloud environment enable instructors and learners to maximize their resources through sharing. Instructors can also share their resources to multiple users based on their needs and demand. Wikipedia (2014) stated *the cloud also focuses on maximizing the effectiveness of the shared resources. Cloud resources are usually not only shared by multiple users but are also dynamically reallocated per demand. This can work for allocating resources to users*.

In meeting the student's demand on shared resources, content management system (CMS) need to be 'always there' when 'there's a need.' The CMS should be convenient to students in order to achieve this task. El-Seoud, M., El-Sofany, H., Taj-Eddin, I., Nosseir, A., & El-Khouly, M. (2013) mentioned *cloud computing through hosting resources and provisioning of services to the students, provides a convenient, on-demand access to a centralized shared pool of computing resources that can be deployed by a minimal management overhead and with a great efficiency*.

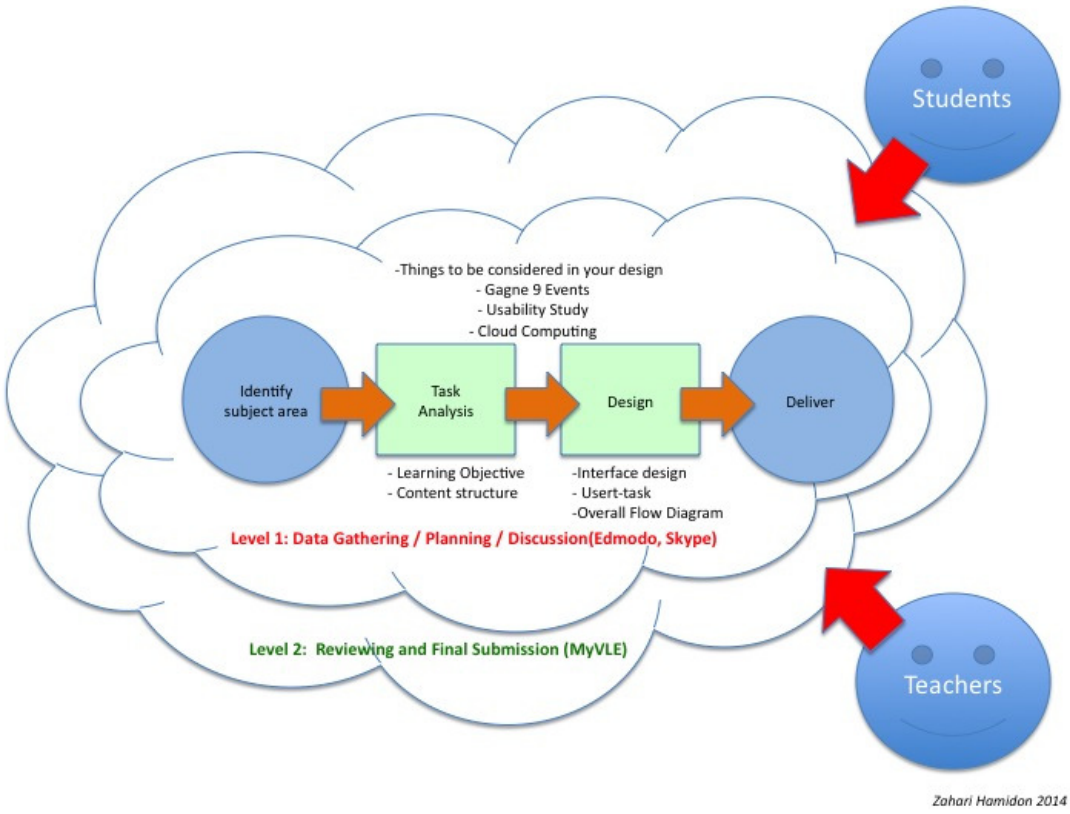


Figure 1: Cloud Learning Environment

Figure 1 shows the Cloud Learning Environment. Its comprises of two level of clouds. The inner level (Level 1) is a preliminary learning process. Students and lecturer aggressively interact to gather all information to support the learning objectives. The outer level (Level 2) is the learning outcomes. Students are required to rectify their learning outcomes from level 1 according to their analysis on their discussion or communication in Level 1.

Literature Review

Communication in Cloud Learning Environment (CLE)

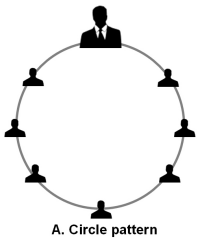
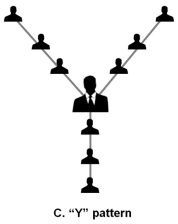
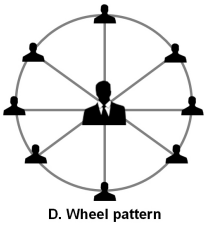
The main idea in communication is to make the whole system works. Adnan (1974) stated that *communication plays a central role in the systems theory* and he added *since system by definition requires interrelationship among parts to constitute a whole, a system of information fiow would necessarily provide information through various subsystems and would entail some feedback mechanism.* In CLE, the complexity depends on the number of components involved. Example, if one chooses to use more than one application from the cloud, it will create more nodes. The information travels from one node to another, which will probably change the nature of the information.

Communication Patterns

Communication pattern plays an important role in determining the users' participation in an online discussion. *Communication patterns are modes of communication that frequently use in certain situations or with certain people* (Wiki Answers, no date). The modes of communication can also create personal reaction in terms of emotion. People tend to communicate to transfer information or knowledge to achieve their intention in sharing information between them.

Communication means transferring messages from one to another and it has several forms such as intrapersonal, interpersonal, group and mass communication (Communication Theory, no date). Figure 2 shows four types of communication patterns. In cloud learning environment, interaction between learners and learners, learner and instructor can easily be visualized by observing the pattern. The four configuration below will guide and give a better insight about communication patterns amongst user.

Figure 2: Communication Patterns by Communication Theory

Communication Pattern	Description
 A. Circle pattern	In Circle pattern, the sender (Group Leader) can communicate with the receivers (group members) who presents next to him/her. No others group members can't receive the sender's message directly and they receive messages from the other group members who sharing the message from the sender. In this pattern of communication the sender messages travels all over the group through sharing by its members will take time to reach sender again
 B. Chain pattern	In Chain pattern, the same problems were appearing as like a circle pattern. The worst part in the pattern is the last member receives the modified messages from the leader. In this case the leader can't find whether the last member receives the correct information or not because there is no feedback to identify the message distortion
 C. "Y" pattern	In Y pattern, it's more complicated pattern and also has the communication problem which appears in both circle and chain pattern. The group is separated into three and the group members can communicate with the other members group through leader only.
 D. Wheel pattern	In Wheel pattern, one of the best pattern while compare to other three. The leader has direct contact with all the group members and there are no communication problems, time issue and feedback from the group members. But all the group members can't connect with one another.

Note: Image and Description From "Communication Patterns," by © Communication Theory (no date). Available from the WWW at http://communicationtheory.org/patterns-of-communication/

Objective of the study

The aim of this study is to observe and examine the pattern of communication between eight postgraduate students in Master of Instructional Design and Technology (MIDT) program. The number of communication between student and student, and between student and lecturer in three sessions; OUM MyVLE forum, Video and message call in Skype and Online discussion in Edmodo were observed. The study also intends to determine the status of communication pattern type as stated the Communication Theory.

Research Questions

1. What is the number of interaction recorded in Internal and External System provided in the Simulated Online Learning Environment?

2. Does the overall communication in an internal system give impact to the number of interaction between student and student, student and lecturer in external system?

3. How can the Cloud Learning Environment as a working definition support the Simulated Online Learning Environment in terms of communication between student and student, student and lecturer?

Methodology

This study focuses on the communication pattern resulting from the dynamic interaction in internal an external system, in simulated learning environment. The data documented in terms of diagram and numbers of communication, will be used to clarify the ideas on communication pattern andevidence provided in the literature review. Three important data are triangulated to confirm the data gained from the communication pattern as shown in Figure 3.

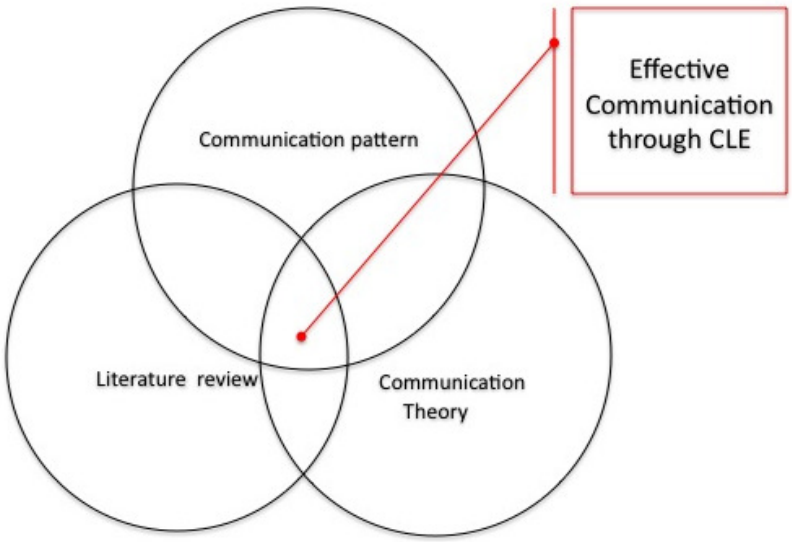


Figure 3: Triangulation of three components for effective communication in Cloud Learning Environment.

The simulated learning environment are designed and embedded into cloud learning environment, according to the working definition. The student undergoes the simulated learning environment

and are required to follow the task posted once a week in Edmodo (refer to appendix 1) The pattern of communication between students is studied and analyzed to gain insight on the number of communication between student and student, and between student and lecturer. The pattern will also reveal numbers of interaction between nodes through MyVLE, Edmodo, Skype and email.

The data on the communication pattern are triangulated with the ideas on communication pattern (Communication Theory, no date) and evidence provided in literature review, for "*apparent truth*" (as stated in O'Grady & O'Grady, 2006:77).

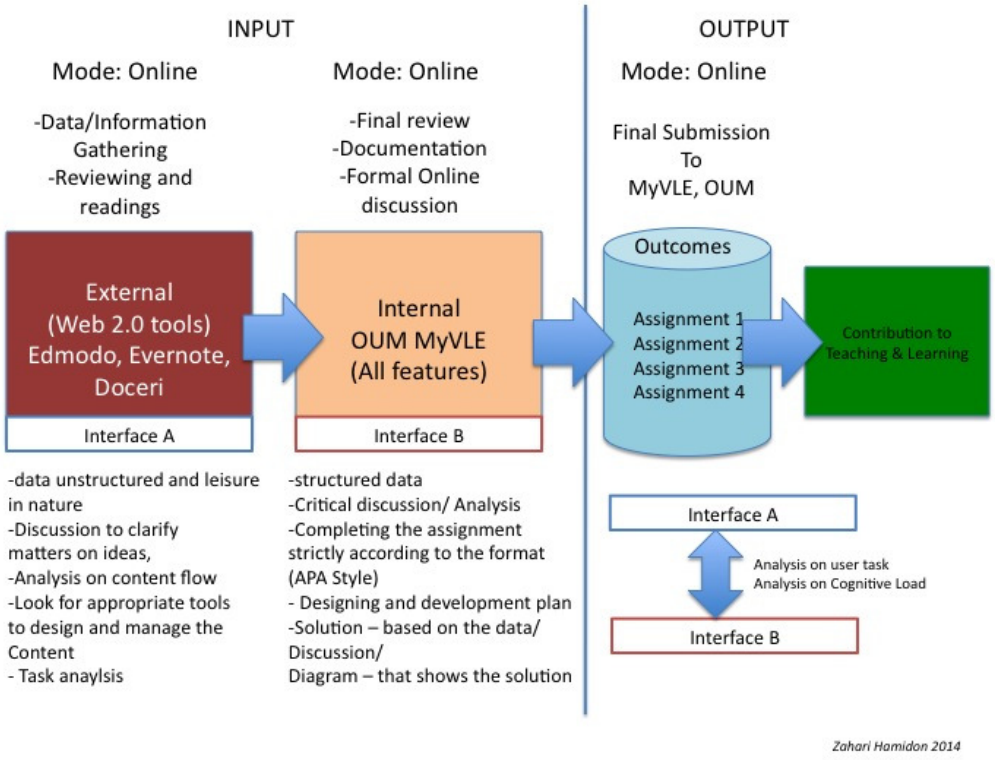


Figure 4. Simulated Learning Environment embedded in CLE

Figure 4 shows a simulated learning environment embedded in the Cloud Learning environment. The learning environment comprises of two main components; input and output. The students and lecturer have undergone the whole process to gain the learning experience in CLE. The learning starts with gathering the data and readings through external learning platform in a leisure way, such as Edmodo, Skype and other relevant resource web page. The learning outcomes gained through external learning platform is considered raw and unstructured. All ideas transmitted in the external learning platform are discussed through online discussion forum and video call.

All amended version of the ideas discussed in the external learning platform are then posted to MyVLE forum provided by OUM. At the second stage, the amended version of the ideas are critically discussed and the post sent should be more formal and structured. Final ideas in stage 2 are then submitted to the Online assignment submission platform in MyVLE for their final submission.

The data are collected by observing the communication pattern in both external and internal learning platform. The pattern yields two important data:

i. numbers of interaction in different time and location
ii. types of interaction in different time and location

The two data are then analyzed to measure the effectiveness of the simulated learning environment in CLE.

Findings and Discussion

Communication Pattern

RQ1. What is the numbers of interaction recorded in Internal and External System provided in the Simulated Online Learning Environment?

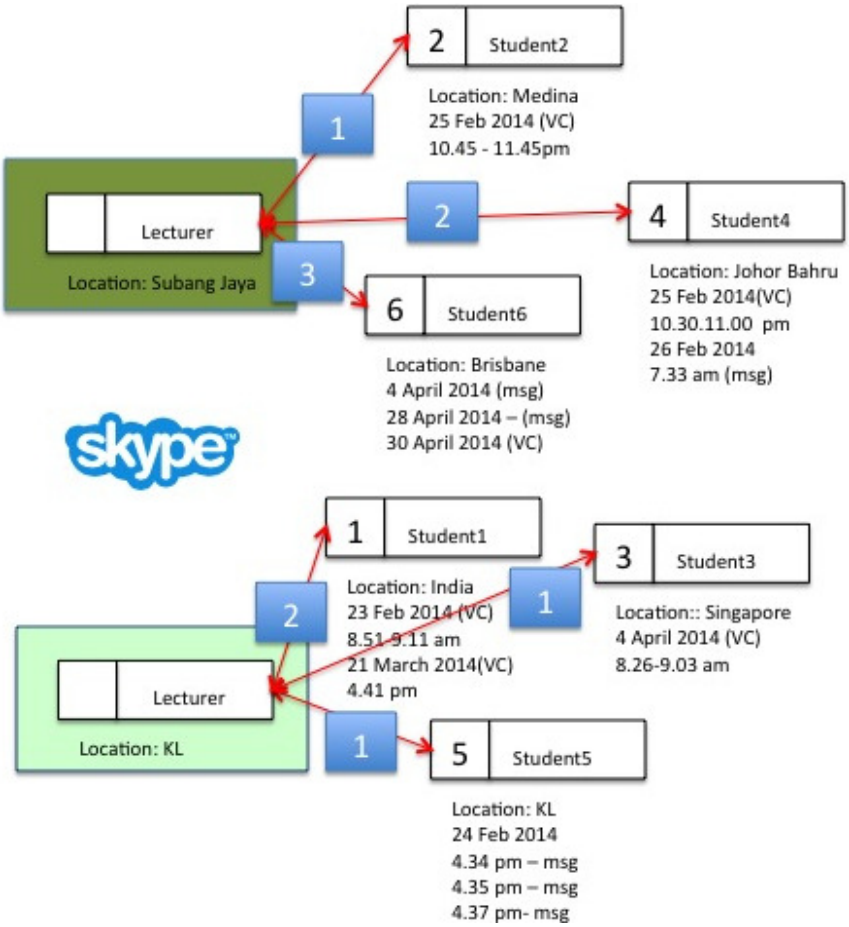


Figure 5: Communication pattern through Video Calls and Message in Skype

Table 1: Numbers and Type of interactions in Skype

Student ID	Date	Time	Location	Type of Interaction	No of Interactions
1	23-Feb-14	8.51 am - 9.11 am	India	Video call	1
	21-Mar-14	4.41 pm		Video call	1
3	4-Apr-14	8.26-9.03 am	Singapore	Video call	1
2	25-Feb	9.44-10.45 pm	Medina	Video call	1
4	25-Feb	7.19 am	Johor Bahru	Video call	1
		10.30-11.00 am		Video call	1
	26-Feb	7.33 am		Message	1
5	24-Feb	4.34 pm	Nilai	Message	1
		4.35 pm		Message	1
		4.37 pm		Message	1
6	4-Apr	9.01 am	Brisbane	Message	1
	28-Apr	4.34 pm		Message	1
	30-Apr			Video call	1
7	Face to face			Face to Face	0
8	No Interaction			None	0
			No of Video calls		7
			No of Message		6
			No of Face to Face		1
			None		1

Table 1 shows the numbers and types of interactions in Skype. The data are summarized as is chart 1 and 2 to determine the a) Time and Numbers of Interactions and b)Time and Location in Skype. The outcomes are used as a guideline to identify the aggressiveness of the communication between students and lecturer and lecturer and the students.

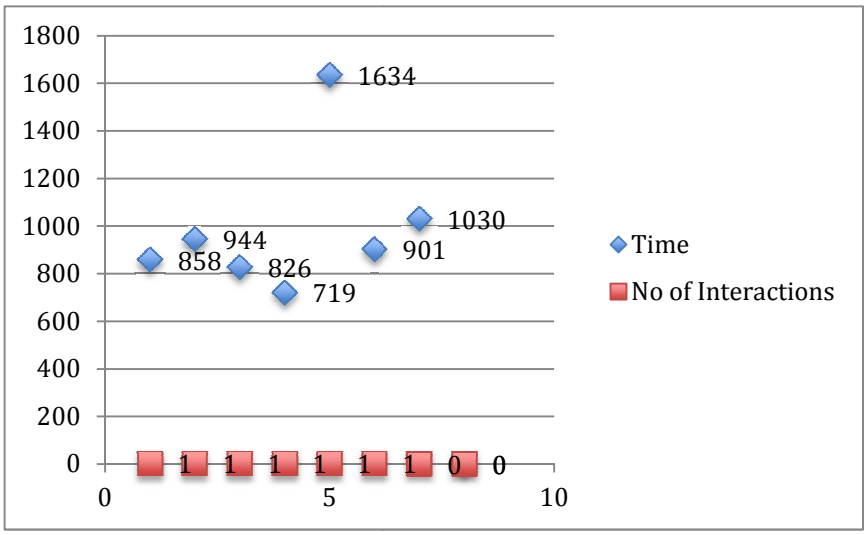


Chart 1: Scatterplot Time and Numbers of Interaction in Skype

Chart 1 shows a scatterplot of Time and Numbers of Interaction in Skype. Most of the interaction occurred within 0858 am to 1030 am at different day. Only one interaction at 1634 pm.

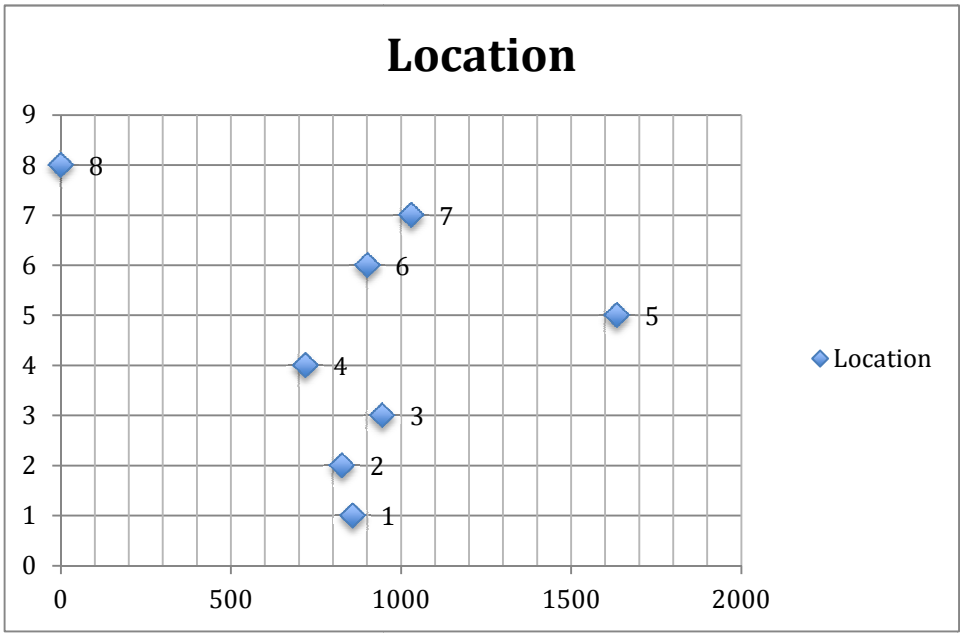


Chart 2: Scatter plot between Time and Location

Location code: 1- India, 2-Singapore, 3- Medina, 4- Johor Bahru, 5- Nilai, 6- Brisbane, 7- Kuala Lumpur, 8- Jakarta

Chart 2 shows the scatter plot of Time and Location in Skype. Most of the students from all places interact with the lecturer within 0800 to 1030 am.

Figure 3 and Table 2 shows the communication pattern at different time and location in Edmodo. Numbers of interaction between lecturer and students seems to be very dynamic. However its one way communication. Table 4 shows four students communicate each others. One student

(Student5) communicate eight times, one student communicate five times (student1), three students interact four times and three students interact two times.

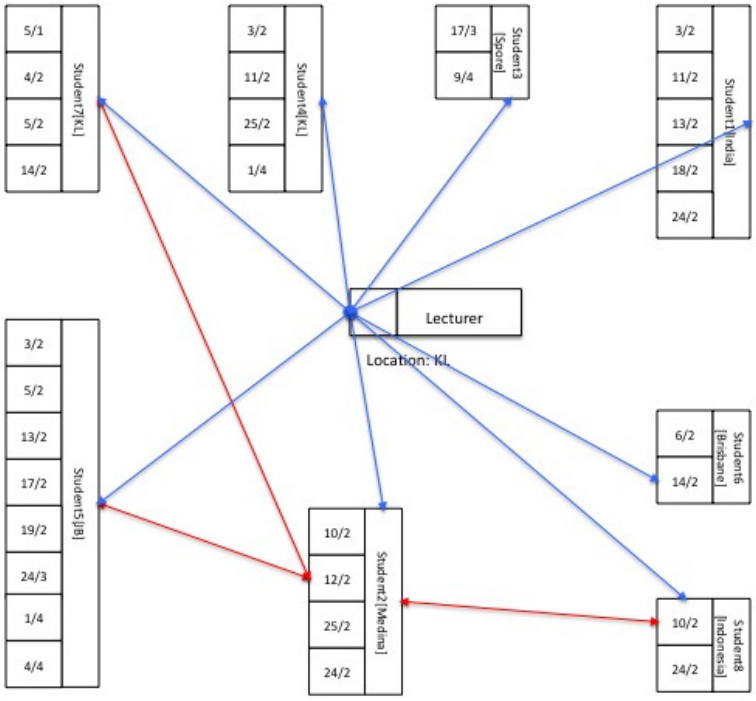


Figure 3: Communication pattern at different time and location in Edmodo

Table 2: Numbers of Interaction between students in Edmodo

Students	1	2	3	4	5	6	7	8	Lecturer
1		0	0	0	0	0	0	0	5
2	0		0	0	0	0	1	1	4
3	0	0		0	0	0	0	0	2
4	0	0	0		0	0	0	0	4
5	0	1	0	0		0	0	0	8
6	0	0	0	0	0		0	0	2
7	0	0	0	0	0	0		0	4
8	0	0	0	0	0	0	0		2
Lecturer	5	4	2	4	8	2	4	2	

Figure 4, Table 3 and Table 4 shows numbers of interactions in online discussion for Topic 1, 2 and 3 in MyVLE, OUM. Only five out of eight students interact with the lecturer. The numbers of interactions recorded with maximum of two reciprocal communication between students and lecturer and one interaction between students. Only three students participated in an online forum for Topic 2 and three with maximum of three reciprocal communication and minimum of one reciprocal communication.

Figure 4: Numbers of interactions in Online Discussion Topic 1, 2 and 3 in MyVLE, OUM

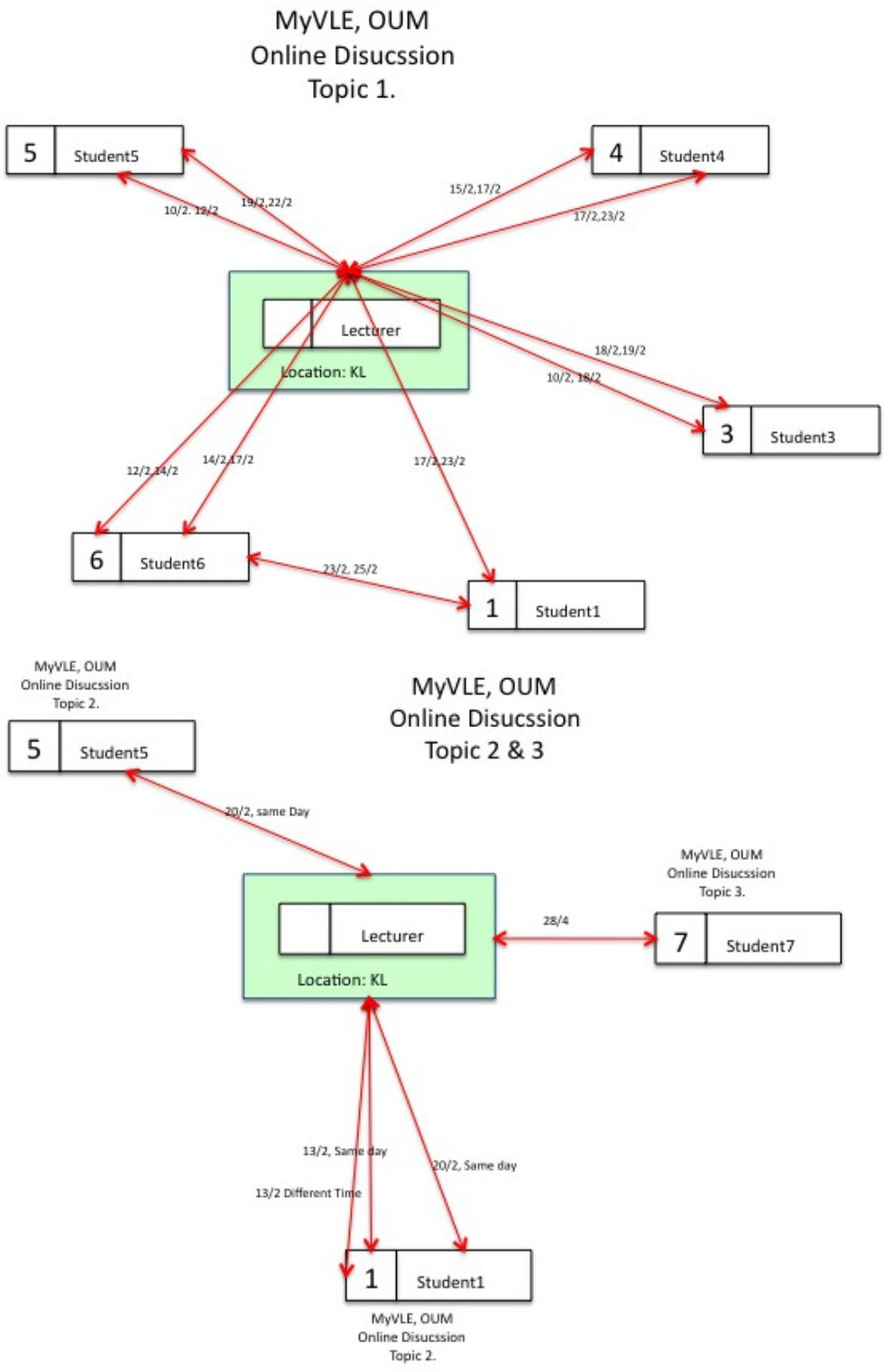


Table 3: Numbers of Interaction between students in MyVLE: Topic 1

Students	1	2	3	4	5	6	7	8	Lecturer
1		0	0	0	0	0	0	0	1
2	0		0	0	0	0	0	0	1
3	0	0		0	0	0	0	0	1
4	0	0	0		0	0	0	0	1
5	0	0	0	0		0	0	0	1
6	0	1	0	0	0		0	0	1
7	0	0	0	0	0	0		0	1
8	0	0	0	0	0	0	0		1
Lecturer	1	1	1	1	1	1	1	1	

Table 4: Numbers of Interaction between students in MyVLE: Topic 2 & 3

Students	1	5	7	Lecturer
1		0	0	1
5	0		0	1
7	0	0		1
Lecturer	1	1	1	

The numbers of interaction recorded in Internal and External System provided in the Simulated Online Learning Environment are summarized as follows:

Table 4: Findings on numbers of interaction through communication patterns in External and Internal System in Simulated Learning Environment

External System (Edmodo)	External System (Skype)	Internal Sytem(MyVLE)
The scatter plots yield shows interaction in Edmodo yield two important factors 1. Only one interaction between lecturer and students for each time. 2. Most of the interaction occurred in the morning session regardless of the location. One interaction occurred on 1400 hours and one with no interaction at all. 3. Most of the communication in edmodo is categorized into Y pattern. The nodes of the communication patterns show only one node from the lecturer to the students and one node from student to student. The group is separated into two main groups and the group members only communicate either with their peers or only with their lecturer.	1. All students only manage to achieve at minimum one video call at different day and time. 2. Most of the video calls occurred in the evening from 10.00 pm onwards (Student 2, 4, 6). One video call at late afternoon (Student5) and two video calls at 0830 am onwards (Student 1 and 3). 3. Referring to the communication pattern by communication theory, this patterns are categorized into Y pattern. It is separated into two groups. Group members can communicate with the other member group through leader (lecturer) only.	1. Figure 4, Table 3 and Table 4 shows that the numbers of interactions in online discussion for Topic 1, 2 and 3 in MyVLE, OUM is also categorized into Y pattern. 2. It shows a lack of aggressiveness in communication between student and student and student and lecturer. Fewer numbers of student participate in MyVLE, online forum.

Conclusion And Recommendation

According to Table 4, numbers of interaction in Edmodo are likely to be better than both Skype and MyVLE and numbers of interaction in Skype is better than MyVLE. The findings show that the overall communication in an external system does not give impact to the numbers of interaction in the internal system.

The virtualization of learning modes created opportunities to students and lecturer to share information and knowledge effectively through dynamic communication in CLE. The simulated learning environment (SLE) can be easily operated due to all information are stored in all online applications.

It is in line with the statement mentioned earlier on student's demand on shared resources. 'always there' whenever 'there's a need' as supported by El-Seoud, et. al., (2013) and Cao Kang (2011) who stated on*the convenience on an on-demand access and an interoperable way of providing and sharing service*.

The most important factors that support the SLE embedded into CLE are its convenience in terms of accessibility. Students and lecturer can communicate anytime, anywhere. Resources available everywhere from internet, the lecturer and students can always update their information and resources.

Moving to cloud computing in teaching and learning give more advantages to the lecturer and students in terms of convenience in delivering the content anywhere and anytime. However, constraints occurred due to the communication pattern in Y category have limited both users to share information through two-way communication between students. There are also lack of aggressiveness of discussion in MyVLE due to fewer numbers of students participate in an online forum.

Excuses on not participating in online discussion due to technology constraints cannot be accepted. In CLE, components of the system such as online applications (apps), learning management system, and so forth. are always available. The ideas mentioned earlier on adjusting and justifying themselves to be a well equipped person in accepting the challenges and constraint in online learning activities, should be considered as critical.

This study only focuses in the communication pattern resulted from learning activities in SLE through CLE. More research on interface design and cognitive load to should be conducted in order to gain more insight in using CLE as one of the solution to enhance the teaching and learning through online.

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Presented in Professional Development in Education (PDE 2014) Conference, Park Hotel, Bandung, Indonesia (11-12 June 2014) Organized by Universitas Widyatama, Universitas Terbuka Indonesia, Open University Malaysia.